MULTIMEDIA UNIVERSITY

STUDENT ID NO

Seat No.: | | | |

Venue: _____

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2018/2019

TGD2151 – COMPUTER GRAPHICS FUNDAMENTALS

(All sections / Groups)

15 OCTOBER 2018
9.00 a.m. – 11.00 a.m.
(2 Hours)

Question No.	Marks
1	
2	
3	
4	
Total	

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 9 pages with 4 Questions only.

2. Answer **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers CLEARLY in this Question paper.

QUESTION 1

a) (i) What is pixel depth?

[1 Mark]

(ii) How pixel depth affects the shades of gray or colors represented in an image?

[2 Marks]

b) A RGB raster system is designed using a 6 inches by 8 inches screen with a resolution of 200 pixels per inch in each direction. If we want to store 6 bits per pixel in the frame buffer, how much storage (in MB) do we need for the frame buffer?

[3 Marks]

c) (i) Find the parametric equation of the line which passes through point $p_0 = (-3, 1, 6)$ and parallel to the vector $v = (5, -1, 2)$.

[2 Marks]

(ii) What is the coordinate of the intersection point q between this line and the $z=10$ plane?

[2 Marks]

Continued...

QUESTION 2

a) (i) Given a straight line with pixel coordinate (-3, 0) to pixel coordinate (6, 6). Indicate which raster locations would be chosen by Bresenham's algorithm up to pixel coordinate [1, 3].

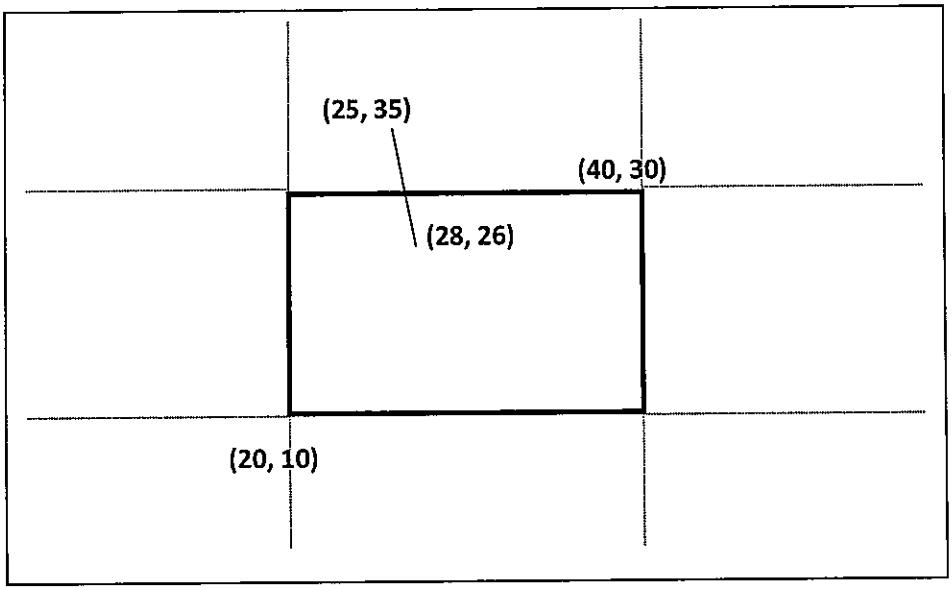
[4 Marks]

(ii) Why is Bresenham's Algorithm better than Analytical method for line drawing?

[1 Mark]

Continued...

b) Given the clipping window coordinates (20,10) and (40,30), s1 = (25, 35) and s2 = (28, 26) represent the two end points for a line),



By using Cohen Sutherland's clipping algorithm,

(i) Identify the region code for both endpoints of the line.

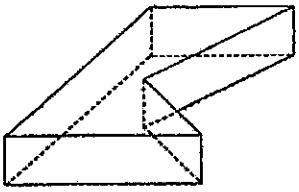
[1 Mark]

(ii) Which case does the line falls into – "Trivial Accept", "Trivial Reject" or "Other Cases"? If the line falls under "Other Cases", compute the intersection point and state the new end point.

[3 Marks]

Continued...

c) Prove that the following object below is a polyhedron. [1 Mark]



QUESTION 3

a) Obtain the composite matrix in homogeneous form for 3-D scaling with respect to point (1, 2, 3), and the scaling factors are $s_x = 4$, $s_y = 5$, and $s_z = 6$.

[2 Marks]

b) (i) Given four 2D control points of a cubic Bezier curve $P_0 = (0, 0)$, $P_1 = (0, 10)$, $P_2 = (20, 0)$ and $P_3 = (20, 10)$, compute the point P on the Bezier curve when u = 0.2.

[3 Marks]

(ii) What are the points that the curve passes through when $u = 0$ and $u = 1$?

[1 Mark]

Continued...

c) Compute the uvn-viewing coordinate reference frame if a camera located at (0,0,0), look at (1,1,1) and the up-vector is (0,1,0).

[3 Marks]

Continued...

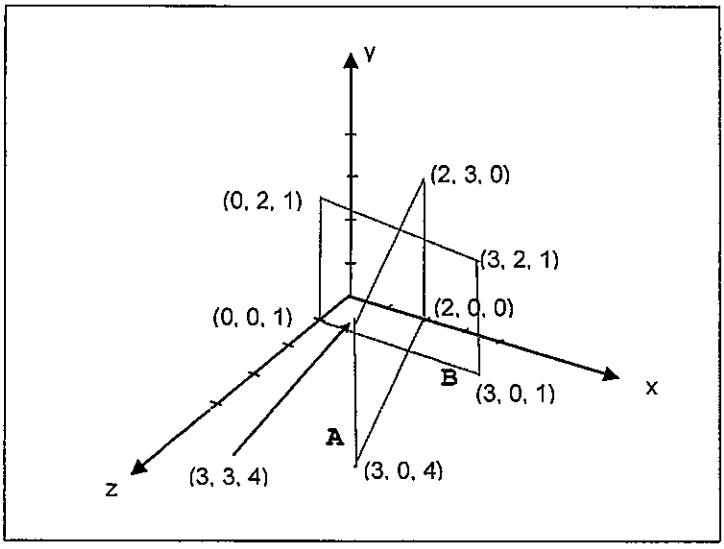
d) Compare Parallel Projection and Perspective Projection.

[1 Mark]

Parallel Projection	Perspective Projection

QUESTION 4

a) The following diagram illustrates two polygons, A and B. Let A be **red** color. The vertices are (3, 0, 4), (3, 3, 4), (2, 3, 0) and (2, 0, 0). Let B be **green** color. The vertices are (0, 0, 1), (3, 0, 1), (3, 2, 1) and (0, 2, 1). The image background is in **blue** color.

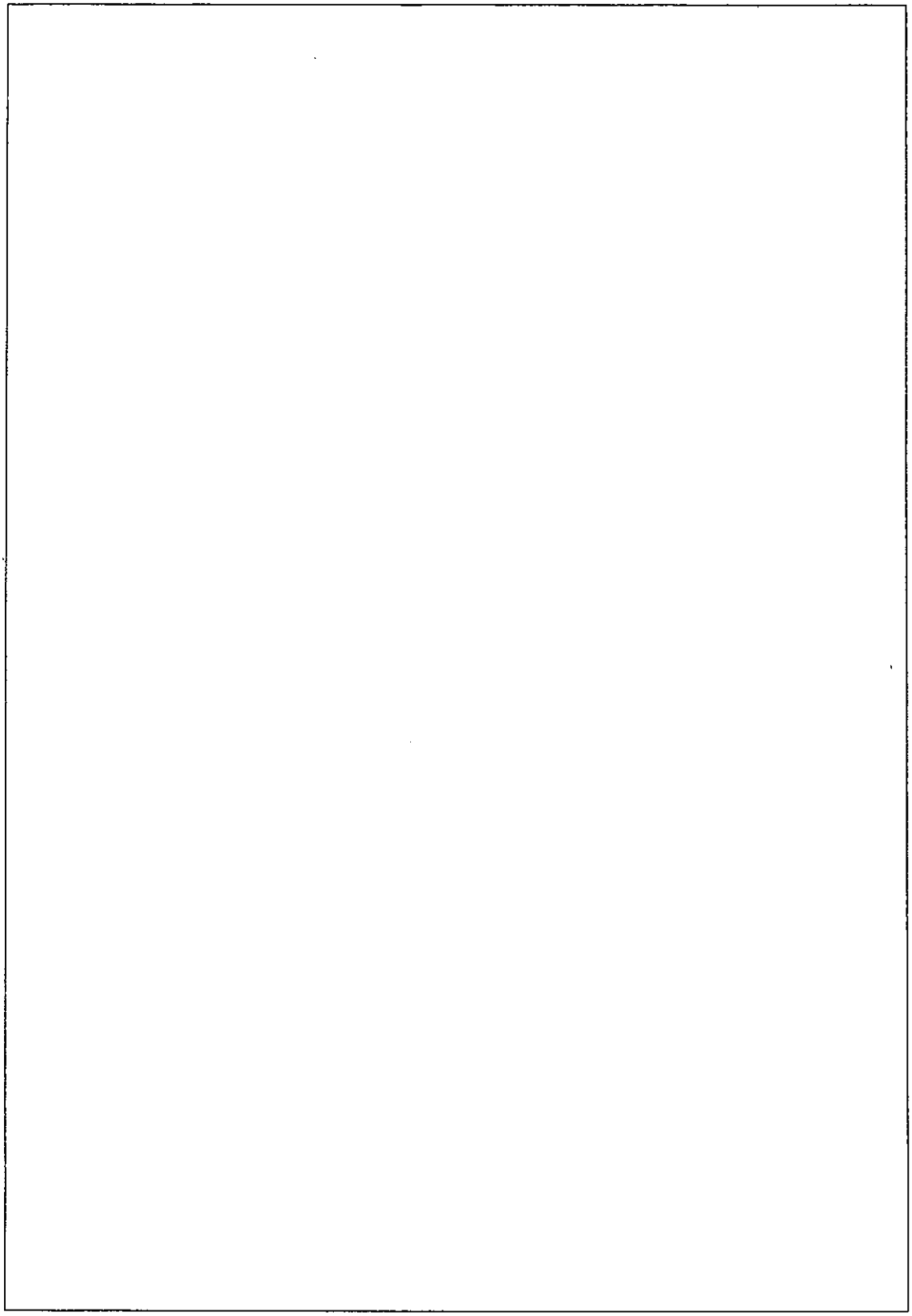


i) Show that the plane equation for A is $-12x + 3z + 24 = 0$.

[2 Marks]

ii) If the pixel display region is $0 \le x \le 3$, $0 \le y \le 3$ and $-1 \le z \le 4$, and assuming the viewer is looking from positive z-axis, show with diagrams how z-buffer algorithm would determine the colour of each pixel in the 4x4 display area for the given object A and B. [3 Marks]

Continued...



Continued...

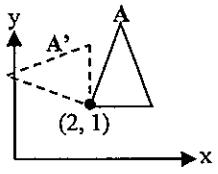
b) Ali was at a position $\mathbf{P_V}$ looking at a cube. A point light source at $\mathbf{P_L}$ shaded light with light intensity of 0.9 onto the surface cube. The materials of the surface cube contain the following properties: Ambient light coefficient, $k_a = 0.3$, diffuse reflection coefficient, $k_d = 0.5$, specular reflection coefficient, $k_s = 0.2$ and specular-reflection exponent, $n = 8$.

i. Compute the intensity of the diffuse reflection at point **A** (1, 2, 0).
[1.5 Marks]

ii. Compute the intensity of the specular reflection at point **A** with the simplified Phong specular reflection model.
[1.5 Marks]

iii. In what situation that the simplified Phong specular reflection model is more efficient than the original Phong specular reflection model?
[1 Mark]

c) Write the OpenGL code for Triangle **A** below to rotate at point (2, 1) for 90 degree. Triangle **A'** is the resultant of the transformation. [1 Mark]



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